

21st Century Novel Technology for Hydrogen Storage and Supply for Fuel Cells using Liquid Organic Hydrides(LOH) “Cyclohexane-Decalin Highway”

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The novel technology of hydrogen supply infra-structures using liquid organic hydrides such as cyclohexane and decaline recently emerge for 21st century hydrogen eco energy society connected with reliable PEM fuel cell. A novel catalytic converter of cyclohexane(or decaline) are developed to produce efficiently pure hydrogen at moderate temperatures. Acyclic conversion of cyclohexane-benzene (or decalin-naphthalene) system is available for efficient, safety and feasible storage and supply for hydrogen fuel car, home electric generator and non-wiring (cable) transportation of electricity generated by solar cells, windmills and other renewable sources as shown in the Figure. We have developed in 1994-1999 the novel Mo carbide and Re based zeolite catalysts which exhibit the practically catalytic performances for dehydrocondensation of methane(natural gas) to simultaneously produce benzene and a bulky hydrogen, and the feasible catalyst stability by addition of a few percents CO/CO₂ in methane feed has been demonstrated due to an effective removal of coke formed on the catalysts. We have constructed the demonstration plant of this direct GTL process at Muroran, Hokkaido, and proceeded the operation with kg-scale catalysts of Mo supported zeolites to produce benzene and hydrogen with a low coke formation. This catalytic technology of methane direct reforming is evaluated as non-CO₂ emission and eco-feasible process for producing pure hydrogen and benzene (cyclohexane) as the efficient and convenient storage and supply of hydrogen.

New Technology of Hydrogen Storage and Supply to Fuel Cell Systems Using Organic Hydrides “Cyclohexane/Decalin Hi-Ways” for Hydrogen Energy Society in Future

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transportation of electricity generated by solar cells, windmills and other renewable sources.

This is attractive industrial technology for future hydrogen eco-energy society connected with reliable PEM fuel-cell. We are going to develop also a novel catalytic converter of cyclohexane to benzene producing efficiently pure hydrogen by platinum catalysts at 180-270°C. A cyclic conversion of cyclohexane-benzene system is available for efficient and feasible storage and supply for hydrogen fuel car, home electric generator and non-wiring (cable) transportation of electricity generated by solar cells, windmills and other renewable sources. The future proposal of this novel catalytic technology for 21st century hydrogen energy society is depicted as follows.

